UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/673,951	09/29/2003	William J. Gunning	99SC083US8	3806

56520 7590 03/15/2007

KOPPEL, PATRICK & HEYBL
555 ST. CHARLES DRIVE
SUITE 107
THOUSANDS OAKS, CA 91360

EXAMINER	
CHANG, AUDREY Y	
ART UNIT	**PAPER NUMBER**
2872	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	03/15/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No.	Applicant(s)	
	10/673,951	GUNNING ET AL.	
	Examiner	Art Unit	
	Audrey Y. Chang	2872	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *05 January 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-30* is/are pending in the application.

4a) Of the above claim(s) *2-5, 8-9 and 13-26* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *29 and 30* is/are rejected.

7)☒ Claim(s) *1,6,7,10-12,27 and 28* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *2/9/2007*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Remark

- This Office Action is in response to applicant's amendment filed on January 5, 2007, which has been entered into the file.
- By this amendment, the applicant has amended claim 1 and has newly added claims 27-30.
- **Claims 2-5, 8-9 and 13-26 are withdrawn** from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected elected species, there being no allowable generic or linking claim. Election was made **without** traverse in the reply filed on April 26, 2006.
- Claims 1, 6-7, 10-12 and 27-30 remain pending in this application.

Claim Objections

1. **Claim 30 is objected to because of the following informalities:**

(1). The phrase "the second wider band" recited in the newly added claim 30 is confusing since it is not clear what is considered to be the second wider band. For the examination purpose, it is being interpreted as the "range of 3-12 microns". Clarification is required.

Appropriate correction is required.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1, 6-7, 10-12 and newly added claims 27-28 are rejected under 35 U.S.C. 103(a) as being unpatentable over the patent publication by Gasser et al (CH 000680534A5) in view of the patent issued to Payne (PN. 6,958,818).

Gasser et al teaches a *Fabry-Perot sensor* that is comprised of a *first and second mirrors* serve as the *first and second reflectors* (9 and 12) held in *substantially parallel* alignment and separated by a *hollow space* (6) serves as *the air gap*. Gasser et al teaches that the mirror (9) is attached to the silicon membrane that may be *deflected* and which implicitly made the hollow space a *variable air gap.* Gasser et al further teaches that the reflectors or the mirrors are made of metal wherein on the surface of each of the mirrors a *silicon nitride coating* (13 and 14) is formed to prevent corrosion, (please see the abstract). Silicon nitride layer is *dielectric* layer. It is implicitly true that the cavity created by the separation of the two parallel mirrors or reflectors in a Fabry Perot device, *is* a *resonance cavity* such that the when the optical thickness of the cavity equals a *multiple of half of a wavelength,* incident light having this wavelength will be selected to be transmitted. **Payne** in the same field of endeavor teaches explicitly the operation of the Fabry Perot filter wherein when the cavity length is an integral multiple of a half wavelength of the selected wavelength (such as $\lambda 2$), the Fabry Perot filter transmits light of the selected wavelength and reflects light of all other wavelengths, (please see Figure 2 and column 3, lines 48 to 55). Payne further teaches that the Fabry Perot filter can be *tuned* by varying the length of the cavity so that the wavelength is transmitted can be tuned within a second wider band, (please see Figure 4). For this matters, the actual cavity of the Fabry Perot sensor of Gasser et al should be defined between the *two mirrors* (9 and 12) such that the *effective cavity* includes the *first and second silicon nitride coatings layers (13 and 14) and the air hollow space (6).* This suggests the effective refractive index of this effective cavity contributed from both the air space and silicon nitride layers, should be greater than one, since silicon nitride has refractive index greater than one. Payne teaches that the optical thickness or the cavity length should be equal to half of the selected wavelength this suggests the effective cavity

including the air space and the silicon nitride coatings should equal to half of the wavelength and this means the optical path length has to be less than quarter wavelength. One skilled in the art can further modify it to have optical thickness of the silicon nitride to be less than quarter of the *shortest* wavelength of the second wider band for the benefit of making the air space the majority part of the effective cavity for the making the effective cavity has the desired structure and effective refractive index to achieve the desired transmittance.

Claim 1 has been amended to include the phrase "*said filter has associated transmission spectrum which shifts to shorter wavelengths as the angle of incidence (θ) of light impinging on the filter increases from normal incidence, said portioned cavity arranged such that the magnitude of said shift for a given θ is less than it would be for a filter having a cavity consisting solely of an air gap*". One skilled in the art would understand that the transmission spectrum associated with the filter is based on the interference properties of the incident light and the spectrum is incident angle dependent. One skilled in the art would understand that the by the interference condition, the maximum for the transmission of the light is determined the equation:

$D^* \cos(\theta_t) = 2^* m^* (\lambda_0)/(4^* n_f)$, (Eq.1)--- (wherein D is the thickness of the medium or layer, θ_t is the refracting angle of the light in the medium or layer, n_f is the refractive index of the medium or layer, m is the interference order, and λ_0 is the wavelength of incident light that will be maximally transmitted). By the Snell's Law, the refracting angle is related to the incident angle θ_I as the following:

$n_1 * \mathrm{Sin}(\theta_I) = n_f * \mathrm{Sin}(\theta_t)$. (Eq. 2)

This means if the incident angle is increased, the cosine of the angle (θ_t) will be decreasing and the wavelength of the incident light that would be maximally transmitted will be shifted to shorter wavelength value. Furthermore, by differentiating the (Eq.1) above, and keeping the angle constant, (for a giving angle of incident), we get: $(d\lambda/dn_f) = (\lambda/n_f)$, this means the wavelength shift will be smaller for larger value of (n_f). Since the effective refractive index of the cavity is greater for having both dielectric

layer and the air gap, than solely having the air gap, this means that the wavelength shift resonance cavity taught by Gasser et al will be smaller than the resonance gap having just the air gap.

With regard to claims 6 and 7, Gasser et al teaches that the dielectric layers (13 and 14) are of the same silicon nitride material. Although it does not teach explicitly that the thickness of these layers are the same, such modification would have been obvious to one skilled in the art for the benefit of making their contribution to the effective cavity be symmetrical on both side of the effective cavity.

Claims 10 and 11 have been addressed in paragraphs above.

With regard to claim 12, Payne teaches that electrical means is used to bias or deflect the reflector to vary the cavity length and therefore tune the filter, (please see column 8, lines 35-36).

With regard to the newly added claims 27 and 28, these references do not teach explicitly that the bandpass wavelength range is within either 3-12 microns or 8-12 microns. However it has been held that a recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus satisfying the claimed structural limitations. Ex parte Madham, 2 USPQ2d 1647 (1987).

Allowable Subject Matter

4. Claim 29 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

5. Claim 30 would be allowable if rewritten or amended to overcome the objection, set forth in this Office action.

6. The following is a statement of reasons for the indication of allowable subject matter: Of the prior art references considered, none has disclosed a *tunable optical filter* for *transmitting* a band of wavelength centered about a *bandpass wavelength* that is tuned within *a range second wider band of 3-12 microns*, wherein the filter is comprised of a *first and second reflectors* held in the manner explicitly

stated in the claims, a *partitioned cavity* including a first dielectric layer on the first reflector, a *variable air gap* and a *second dielectric layer* on the second reflector, said the partitioned cavity having an *effective optical thickness* substantially equal to an integral multiple of one half of the bandpass wavelength and having an *effective refractive index greater than two* and said first and second dielectric layers each having an *optical thickness less than* one fourth of the shortest wavelength within the second wider band.

Response to Arguments

7. Applicant's arguments filed on January 5, 2007 have been fully considered but they are not persuasive. The newly amended and newly added claims have been fully considered and they are rejected or objected for the reasons stated above.

In response to applicant's arguments which state that layer thickness for the dielectric layers of cited Gasser et al is too smaller for providing the wavelength shifts of the transmission spectrum with respect to the variation of the incident angle, the examiner respectfully disagrees for the reasons stated below. As stated above the interference properties for determining the transmission spectrum is stated as follows: $D^* \cos(\theta_t) = 2^* m^* (\lambda_0)/(4^* n_f)$, (wherein D is the thickness of the medium or layer, θ_t is the refracting angle of the light in the medium or layer, n_f is the refractive index of the medium or layer, m is the interference order, and λ_0 is the wavelength of incident light that will be maximally transmitted), By the Snell's Law, the refracting angle is related to the incident angle θ_I as the following: $n_1 * \mathrm{Sin}(\theta_I) = n_f * \mathrm{Sin}(\theta_t)$. From these equations one can easily find the relationship between the incident angle and the shifting of the wavelength in the transmission spectrum. It is explicitly clear that the relationship is not dependent on the thickness of the dielectric layer but is an inherent property of *resonance cavity*, (despites what the cavity is composed of). In this matters, the wavelength shift of the transmission spectrum with respect to the increasing of the incident angle is inherently met by the resonance cavity structure of Gasser. Further, by including the dielectric silicon nitride layer in the

resonance cavity, the effective index of the cavity is increased, (noted the wavelength intended is between 500 nm to 700 nm, column 1, lines 25-35), this means the effective refractive index can be increased from 1 (of air gap) to 1.32, which requires the wavelength shift for a given angle be smaller for the resonance cavity than single air gap cavity.

8. In response to applicant's arguments concerning the combination of cited Grasser reference and the Payne reference, the applicant is respectfully invited to read the reason for rejection one more time. The cited Payne reference is provided to demonstrate the resonance gap is having an optical thickness of multiple of half wavelength.

Conclusion

9. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Audrey Y. Chang whose telephone number is 571-272-2309. The examiner can normally be reached on Monday-Friday (8:00-4:30), alternative Mondays off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stephone B. Allen can be reached on 571-272-2434. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Audrey Y. Chang, Ph.D.
Primary Examiner
Art Unit 2872

A. Chang, Ph.D.